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On the Annual Fluctuations in the Number of Deaths from Various Diseases, compared with like Fluctuations in Crime, and in other Events within and beyond the Control of the Human Will. By WILLIAM A. GUY, M.B., Cantab., Fellow of the Royal College of Physicians; Professor of Forensic Medicine, King's College; Physician to King's College Hospital; and one of the Honorary Secretaries of the Statistical Society.

[Read before the Statistical Society, December 15, 1857.]

IN the autumn of 1855 I presented to the Statistical Section of the British Association, then meeting at Glasgow, a Paper "On the Fluctuations in the number of Births, Deaths, and Marriages, and in the number of Deaths from Special Causes, in the Metropolis, during the 15 years, from 1840 to 1854 inclusive." It was one of the objects of that Paper to invite attention to the fluctuations in question, and especially to the fluctuations in the mortality from special causes; but I took occasion to state that I should find another opportunity of turning to other account the figures contained in the Paper. This I now propose to do.

It may be necessary to premise that the figures I am about to make use of in the first part of this Essay represent the number of deaths from the several specified causes in a million of persons living during a year of 365 days; and that the average annual fluctuation (for I propose throughout this communication to restrict myself to average fluctuations,) must be understood to be "the quotient obtained by dividing the sum of all the successive differences between year and year, whether in excess or defect, by the number of those differences, and then reducing that quotient to a per-centage proportion of the average of all the years."

I shall preface what I have to say on the proper subject of this Paper by a few remarks on the larger figures of my former communication, using those figures in such a manner as to establish a few general principles bearing directly on the value of the results afterwards to be worked out.

One question which will naturally suggest itself in reference to these annual fluctuations has reference to their value as materials for solving such problems as may offer themselves for consideration. Are these numerical fluctuations to be regarded as chance combinations of figures, or as consistent results of causes acting in combination, and varying with the number and nature of those causes? An answer to this question would seem to be provided in Tables I, II, and III, of my former Essay, containing a return of the births and deaths in London, during 15 years, per million of inhabitants in a

year of 365 days. The male and female births, taken together, present a mean fluctuation; the births of 1·95, or nearly 2 per cent., and the deaths of 9·51, or $9\frac{1}{2}$ per cent. Now if these figures were the result of what is vulgarly called chance, it is certain that their fortuitous origin would betray itself in the figures which represent the fluctuation in the births and deaths of males and females respectively. But this is so far from being the case, that when this separation between the two sexes is made, the figures which represent the mean fluctuation for males and females are found to differ very slightly from each other. The fluctuation in the births is 2·05 for male children, and 2·10 for female children; and the fluctuation in the deaths 9·26 for males and 9·88 for females.

The inferences to which these comparisons lead us, namely, 1. That the fluctuations from year to year are not fortuitous, and 2. That the differences between the two contrasted series of facts are as inconsiderable as the introduction of the single element of sex in addition to the aggregate of causes, whatever it may be, which determines the conception and birth of children would lead us to expect—these inferences are confirmed and strengthened when, for the difference in the mortality occasioned by the element of sex, we substitute the difference due to the element of age. This difference is also very slight, for while the mean annual fluctuation in the deaths under 15 years of age amounts to 9·65, it is 10·84 in the deaths above 60, and 11·38 in the deaths during the intermediate period, from 15 to 60.

Here, again, the difference between the three orders of facts is such a difference as the introduction of the single element of age among the numerous causes which combine to bring about the event of death would naturally lead us to expect. And here, too, there is a difference between the three series of facts too small to give any countenance to the notion that the numerical results have been in any way under the dominion of chance.

If now, from the differences in mortality introduced by sex and age, we pass on to those occasioned by locality, we find ourselves dealing with a new order of figures. Instead of mean fluctuations differing but little from each other, we encounter very considerable divergences. Thus while the mean annual fluctuation in the mortality of the *Northern* district of the Metropolis is only 5·67, that of the *West* district rises to 8·49, that of the *Central* district to 9·45, that of the *East* district to 9·56, and that of the *Southern* district to 21·50. These differences, great as they are, are not more considerable than our knowledge of the powerful influence exercised on human life by locality would lead us to anticipate. It is but reasonable to conclude that the fluctuations in the mortality from year to year on the swampy south bank of the Thames would exceed the fluctuation on the north bank.

tuations on the abruptly sloping, hilly, northern bank in a much greater degree than the fluctuation in the mortality of females would exceed that of males, or the fluctuations in the mortality of middle aged or old persons that of children.

From this brief consideration, then, of the figures to which reference has been made, I am led to infer that the differences, whether small or great, between one order of facts and another are not fortuitous, but dependent upon the addition to the multitude of causes co-operating to bring about a given event of a new element of greater or less efficiency, and of which the greater or less force makes itself, so to speak, felt in the figures themselves.

Another inquiry, which may be advantageously instituted as a preliminary to the consideration of the proper subject of this Paper, and by the aid of the facts already published, relates to the force of the human will as compared with other forces. It is certainly interesting, if it be not important, to ascertain whether events brought about wholly or chiefly by the agency of the will display greater or less steadiness, that is to say, more or less considerable fluctuations from year to year, than other events in the bringing about of which the will has either no part at all, or only a very remote and subordinate one.

Now the three orders of facts, births, deaths, and marriages, supply the means of comparing this working of the human will with the operation of other and different causes; for, while the human will, by determining the number of marriages in previous years, is remotely concerned in bringing about the event of birth, and, in a comparatively small number of instances, through unhealthy habits foolishly contracted and perversely cherished, the event of death, a marriage may be said to be in the main an event directly determined by the volition of the parties to the marriage modified and restrained by the wills of parents, guardians, or relatives.

On comparing the three orders of facts, births, deaths, and marriages, we find marriages occupying in point of steadiness, from year to year, an intermediate position between births and deaths, the mean fluctuations being as follows:—

Births 1·95		Marriages 3·75		Deaths 9·51
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The order of facts, therefore, which the human will is most influential in bringing about is found to present greater steadiness from year to year than the one which results mainly from the operation of a multitude of causes other than the human will; but less steadiness than the one which, from *à priori* reasoning, we should expect to be least subject to disturbance from volition or from external influences. It is also worthy of remark that the rate of marriage-fluctuation approaches much more closely to the fluctuation in the births than to

the fluctuation in the deaths; and when we reflect that the operation of the human will has already made itself felt as a remote cause of the fluctuation in the number of births, we cannot fail to estimate very highly the uniform and constant operation of those causes which directly determine the conception and birth of children.

As this relative fluctuation in births, deaths, and marriages, is a subject of some interest, I have thought it worth while to extend this comparison from the Metropolis to the whole of England and Wales. The following are the results obtained:—

England and Wales, 15 Years, from 1840 to 1854 inclusive.

Births, annually	32,920		Fluctuation	2·01
per million				
persons living				
Marriages „	8,205		„	3·29
Deaths „	22,490		„	5·57

The three orders of facts are here seen to occupy the same relative position for England and Wales as for the Metropolis, the figures having, however, undergone considerable change; the fluctuation in the births being slightly increased (from 1·95 to 2·01) the fluctuations in the marriages being diminished (from 3·75 to 3·29), and the fluctuations in the deaths being also diminished, but more considerably (from 9·51 to 5·57). For all England the rates of fluctuation for births, marriages, and deaths, are as the numbers 2, $3\frac{1}{4}$, and $5\frac{1}{2}$.

It is worthy of remark that this substitution of a large for a comparatively small number of facts, though it changes, and, in two cases (Marriages and Deaths) reduces, the figures representing the mean annual fluctuation, does not alter the relative position of the three orders of facts. The births for all England, as for the metropolis, exhibit the least, and the deaths the greatest, rate of fluctuation.

This reduction in the rate of fluctuation, coinciding in two out of three instances, with an increase in the number of facts, suggests the inquiry whether, as a general rule, the rate of fluctuation does diminish as the number of facts increases.

With a view to the solution of this question, I have placed side by side some of the facts relating to the metropolis, and the corresponding facts relating to the whole of England and Wales, for the seven years 1848 to 1854 inclusive, making use, for this particular purpose, of the original facts as published by the Registrar-General, without correction for increase of population. It will be seen that the diseases chosen for comparison are well defined and easily recognised maladies, likely to be registered with similar accuracy both in town and country.

The facts are comprised in the following table, in which, as just

stated, no correction has been made for increase of population either in London or in England.

TABLE I.

Causes of Death.	LONDON.		ENGLAND.	
	Number of Deaths.	Fluctuation.	Number of Deaths.	Fluctuation.
Measles	1,086	31·50	6,971	33·90
Scarlatina	2,486	45·58	16,249	19·65
Hooping Cough.....	2,056	31·96	8,736	18·07
Typhus	2,543	19·80	17,844	10·41
Phthisis	6,797	5·79	50,649	5·58
Bronchitis and } Asthma	4,578	14·86	21,706	10·72
Cancer	940	4·96	5,255	3·28
Apoplexy	1,270	5·84	8,028	2·95
Delirium Tremens...	146	12·00	517	5·06
Violence, Privation, } &c.	2,008	8·15	14,129	3·44

With the single exception of Measles, which exhibits a higher rate of fluctuation in the whole of England than in London, the other diseases, in conformity with what we should be led to expect *a priori*, show a higher rate of fluctuation for the smaller than for the larger number of deaths, though the disparity, in one instance, (that of Phthisis, or Pulmonary Consumption,) is very inconsiderable.

As, however, this reduction of the rate of fluctuation might possibly be attributed to the widening of the area over which the observations extend, and not to the mere increase in the number of facts, I have thought it worth while to put the alternative to the test by means of a series of trivial facts progressively increasing in number, of which an account is given in an Appendix. At present I shall content myself with stating that the amount of fluctuation existing between a series of numerical returns diminishes as the facts increase; and I shall make practical use of this principle by contrasting, where it is possible so to do, one series of facts with another of equal, or nearly equal, number.

Before quitting the consideration of the foregoing table, I may observe, (in order to prepare the way for the more exact comparison presently to be made between events brought about by the human will, and those which owe their origin to other causes), that the rate of fluctuation in deaths from Delirium Tremens, brought on as they are, by a more or less deliberate indulgence in habits of intemperance; and in deaths from Violence and Privation, which comprise the fatal issues of voluntary acts, suicidal or homicidal, is comparatively small. The fluctuation for England and Wales in the case of Delirium

Tremens is, in round numbers, only 5 per cent., and in the case of deaths from Violence and Privation, only $3\frac{1}{4}$ per cent.

An inspection of Table I, will also serve to prepare us for the results embodied in the more elaborate tables presently to be submitted. The high rate of fluctuation of the four contagious maladies, Scarlatina, Measles, Hooping Cough, and Typhus Fever, contrasts in a very striking manner with the moderate rate of fluctuation of Bronchitis and Asthma, and the still lower fluctuation of Pulmonary Consumption, Cancer, and Apoplexy; of Delirium Tremens, and deaths from Violence and Privation. The different rates of fluctuation displayed in this table, will serve to show that some interesting and curious results may be expected from the further prosecution of this inquiry.

Having now established, not as new principles, but as special inferences from the facts with which I am now dealing, the three propositions:—1. That the fluctuations which take place in different orders of facts from year to year are not fortuitous; 2. That the amount of fluctuation is in part determined by the number of facts, the rate of fluctuation diminishing as the facts increase; and 3. That the fluctuations in the number of events brought about by the human will may be less considerable than those resulting from the operation of causes over which the will has no control; I proceed to consider the first of the two subjects specified in the title of this paper:—I mean the annual fluctuations in the number of deaths from various diseases.

Before I present the facts themselves for consideration, I may premise that, with a view of avoiding those large fluctuations which are incidental to mere smallness of number in the facts themselves, I propose to exclude from consideration all those diseases which occasion an annual average mortality of less than 100 deaths. The diseases which remain after this elimination, will supply a sufficient number of individual instances to illustrate the few general principles which I am seeking to establish; and will afford the necessary data for that comparison of disease with crime, which forms the second object of this communication.

The following table embodies the results obtained in my former communication, in fifteen out of seventeen of the classes of disease given in the reports of the Registrar General. Diseases of the Skin and Malformations are excluded, as supplying year by year less than 100 facts. The several classes of disease are arranged in the table in the order determined by the amount of fluctuation, that class being placed first which presents the least amount. It should also be borne in mind that the average number of deaths is the calculated average for the metropolis, for 15 years, in a population of one million persons, during a year of 365 days.

TABLE II.

	Average Number of Deaths.	Mean Fluctuation.
Diseases of the Brain, Nerves, &c.	2,858	3.50
" Digestive organs	1,504	4.25
{ Tubercular Diseases	4,427	4.25 }
Debility from premature birth, &c.	579	5.01
Dropsy, Cancer, and others of uncertain seat	1,226	5.22
*Violence, Privation, &c.	769	6.89
Disease of the Kidneys	231	7.80
" Heart, &c.	785	8.02
" Uterus, viz., Puerperal Disease, &c.	280	9.30
" Joints and Bones, viz., Rheumatism, &c.	189	10.60
Age	1,298	10.71
Diseases of the Respiratory Organs	3,747	11.26
Atrophy	470	14.68
Sudden	292	17.46
Zymotic Diseases	5,957	31.24

In this table I have distinguished, by an asterisk, that class of deaths which is most distinctly affected by the operations of the human will, the majority being directly brought about by human volition; and it will be seen that this class occupies the same sort of intermediate position, between causes of death characterised by a low rate of fluctuation, and causes distinguished by a high rate of fluctuation, which inarriages did between births and deaths, the rate of fluctuation in deaths by violence, &c., approximating more closely to the diseases marked by a low rate of fluctuation, than to those subject to a high rate of fluctuation. The table also contains one group in which the number of facts approximates so closely to the number of deaths by violence as to suggest a special comparison of the one with the other. The group in question is that of Diseases of the Heart and large Blood Vessels, in which an annual average of 785 facts yields a mean fluctuation of 8.02, against 6.89, the mean fluctuation in 769 deaths due to Violence, Privation, &c. So that the number of deaths brought about from year to year, chiefly by the misdirected operation of the human will, shows greater steadiness than the similar number of deaths due to one of the best defined classes of disease.

There are some other points in the table worthy of notice. It is certainly a curious circumstance that the fatal diseases which show the greatest freedom from fluctuation, should be diseases of the Brain and Nervous System, which of all diseases most influence human volition; and that the amount of annual fluctuation in this class should be less than in the case of the diseases of any other important organ of the economy. Thus, while the mean fluctuation in the deaths from the Diseases of the Brain and Nervous System is

represented by the low figure 3·50, the fluctuation for Diseases of the Heart, &c., is represented by 8·02; and that for Diseases of the Organs of Respiration, by 11·26. These figures suggest the inquiry, whether the striking difference between the three sets of figures may not be explained by the different degree to which the Diseases of the Brain, Heart, and Lungs, respectively, are influenced by causes external to the body.*

Another group of diseases which will naturally attract attention, is that which stands third in the table, namely, Tubercular Diseases, of which Pulmonary Consumption forms the most conspicuous member. This interesting group shares with Diseases of the Digestive Organs the very low mean fluctuation represented by the figures 4·25. Now it happens that the average annual number of deaths in this class is 4,427—a number differing very slightly from the mortality in the central and northern districts of the metropolis. Hence we are able to obviate any objection which might arise out of a great disparity in the number of our facts, and to make the following instructive comparison :—

	Deaths.	Fluctuation.
Tubercular Diseases	4,427	4·25
Northern Districts	4,670	5·67
Central Districts	4,402	9·45

* Since this Paper was read I have had occasion to refer to the Registrar-General's "Summary of Births, Deaths, and Causes of Deaths in London for the 15 years 1842-1856," in which I find an interesting comparison between the deaths in London in 10 cold and 10 warm days occurring in the months of November and December, 1856, which comparison goes far to answer this question. Between the mean temperature of the 10 cold and 10 warm days there was a difference of about 20° Fahr.; and the deaths from the three causes mentioned in the text were affected to the extent shown by the following figures :—

	10 Warm Days.	10 Cold Days.	Increase.
Pulmonary Consumption	163 deaths	232 deaths	+ 42 per cent.
Bronchitis and other Dis- eases of the Lungs.....	394 „	502 „	+ 27 „
Diseases of the Heart	51 „	73 „	+ 31 „
Diseases of the Brain	172 „	170 „	

The extraordinary steadiness of Diseases of the Brain contrasts, in a very striking manner, with the increased mortality from Diseases of the Heart and of the Lungs; and it will be seen that these figures afford a very striking confirmation of the results obtained in the text, and an unexpected answer in the affirmative to the question there raised. If Consumption were included in one class with other Diseases of the Chest the figures would follow the same order as those quoted in the text.

The inferences to be drawn from this comparison admit of being strengthened, by separating from the compound group of Tubercular Diseases (Scrofula, Tabes Mesenterica, Phthisis, and Hydrocephalus) the single disease Phthisis or Pulmonary Consumption.

This disease occasions a mean annual mortality of 3,230, or little short of the deaths in the western district of London, and of the mortality from Diseases of the Organs of respiration, exclusive of Deaths from Consumption. Hence the following comparison :—

	Deaths.	Fluctuation.
Pulmonary Consumption	3,230	4·45
Western Districts	3,676	8·49
Diseases of Lungs, &c., (ex- clusive of Consumption)	3,747	11·26

From the first of these comparisons we learn that Tubercular Diseases, due to a natural infirmity or degeneracy of the body itself, give rise to a mortality subject to less fluctuation than that which belongs to the district of the metropolis showing the greatest steadiness in this respect; and from the second, that Pulmonary Consumption, the most important disease of the Tubercular class, shows the same steadiness when compared with the deaths in the western district of London, or with the mortality from Diseases of the Lungs and Air-Passages, from which this important disease—Consumption—has been excluded. Table I. had already taught us that Cancer and Apoplexy,—diseases also dependent upon peculiar structural changes—present a degree of steadiness still more remarkable.

If we were to seek for a striking contrast to this small fluctuation in the class of Tubercular diseases, and in other groups at the head of Table II, we should find it in the extraordinary fluctuation in the mortality from Zymotic Diseases, which, on an average of about 6,000 deaths, displays the high mean fluctuation of 31·24.

Table II, then, has afforded some confirmation to the inference that events brought about by the operation of the human will display, in respect of mean annual fluctuation, a degree of steadiness intermediate between the extremes of fluctuation observable in events over which the human will exercises no control; and it has also taught us that diseases dependent on degeneracy of the structure of the body, recur from year to year with a regularity which contrasts very strikingly with the violent annual fluctuations occurring in the class of diseases most subject to external influences.

I now proceed, by the aid of a table of special diseases, to inquire how far these results admit of confirmation or otherwise.

From Table III, as from Table II, all those diseases are omitted

which occasion, on an average, less than 100 deaths per annum; and the remaining causes of death are arranged in the order of the amount of fluctuation.

I shall also enlarge the table by introducing, in their proper places, the fluctuations embodied in Table II, or noticed in previous parts of this paper. It will also be observed that the table is arranged in two columns, the left-hand column commencing with the highest, and the right-hand column with the lowest, fluctuation, so as to bring the extremes into juxtaposition. In order still further to facilitate the work of comparison, the columns of mean fluctuation are brought into contact with each other. The last half of the table must, of course, be read backwards.

TABLE III.

Showing the Fluctuations from Various Causes in the 15 Years, 1840 to 1854 inclusive.

Cause of Death.	Number of Deaths.	Mean Fluctuation.	Mean Fluctuation.	Number of Deaths.	Cause of Death.
1. Cholera	780	153.97	3.50	2,858	Diseases of the Brain and 62
2. Influenza	110	95.45			Nerves
3. Small Pox	399	69.92	4.16	264	Do. (residue)..... 61
4. Scarlatina	899	59.51	4.25	1,504	Diseases of Organs of Diges- 60
5. Measles	575	41.74			tion
6. Zymotic Diseases	5,957	31.24	4.25	4,427	Tubercular Diseases 59
7. Hooping Cough	857	31.04	4.45	3,230	Pulmonary Consumption 58
8. Diarrhoea	747	29.45	5.00	280	Inflammation of the Brain.... 57
9. Typhus Fever	951	23.55	5.01	579	Debility from Premature 56
10. Bronchitis	1,148	22.12			Birth, &c.
11. South District of } London.....	6,535	21.50	5.22	1,226	Dropsy, Cancer, &c..... 55
			5.67	4,670	North District of London.... 54
12. Asthma	452	19.47	6.00	767	Water on the Brain 53
13. Erysipelas	164	17.68	6.11	458	Paralysis 52
14. Causes not specified	170	17.65	6.60	349	Cancer 51
15. Sudden	292	17.46	6.89	769	Violence, Privation, &c. ... 50
16. Scrofula	122	14.75	6.92	1,098	Convulsions 49
17. Atrophy	470	14.68	7.06	524	Apoplexy 48
18. Tabes Mesenterica ..	307	12.70	7.80	231	Diseases of the Kidneys 47
19. Teething	325	12.48	8.02	715	Diseases of the Heart, &c. 46
20. Dropsy	588	12.41	8.49	3,676	West District of London 45
21. Diseases of the Sto- } mach (residue)	131	12.21	8.50	153	Disease of Kidneys (residue) 44
			8.86	316	Inflammation of the Stomach 43
22. Epilepsy	132	12.12			and Bowels
23. Age 15 to 60	8,263	11.38	8.98	167	Croup 42
24. Diseases of Organs } of Respiration	3,747	11.26	9.26	12,629	Deaths, all causes, Males 41
			9.30	280	Puerperal Diseases, &c. 40
25. Diseases of the } Lungs (residue) ..	282	10.99	9.45	4,402	Deaths, Central District of 39
			9.51	24,864	London
26. Inflammation of the } Lungs	1,740	10.92	9.55	24,712	Deaths, All Causes 38
			9.56	5,435	Deaths from specified causes 37
27. Child-birth	193	10.88			Deaths Eastern District of 36
28. Deaths at ages 60 } and upwards.....	4,987	10.84	9.65	11,499	London
			9.83	241	Deaths at ages 0—15 35
29. Age	1,298	10.71			Diseases of Liver 34
30. Thrush	103	10.68	9.88	12,240	Deaths, all causes, Females 33
31. Rheumatism, &c.	189	10.60	10.00	101	Rheumatism (residue) 32

Now it will be observed that this table is unequally divided by the mean fluctuation in deaths from All Causes amounting to 9·51, into two parts, the first consisting of 37 causes of death, the second of 24 causes of death. The first section contains all the causes of death in which the mean fluctuation exceeds $9\frac{1}{2}$ per cent. ; the second section all those in which it falls short of $9\frac{1}{2}$ per cent. In the first section it will be observed that all the diseases belonging to the Contagious, Epidemic, or Zymotic class find their place ; while in the second section there is a very marked predominance of diseases of a very defined character, and of those attacking particular organs or parts of the body. If we examine the table still more narrowly, we find that the leading Zymotic maladies are all comprised in the first 13 causes of disease ; while, on the other hand, Tubercular Diseases, Pulmonary Consumption, Water on the Brain (classed in the returns of the Registrar General with Tubercular Diseases) Paralysis, and Cancer ; in other words, all the best defined instances of degeneracy in the structure of the body itself are to be found in the last 13 causes of death.

If to the first 13 causes of death we add two more, making up the number to 15, we reach a part of the table separated from that which succeeds it, by nearly 3 per cent., and characterised by a very high rate of fluctuation. Taking this group of 15 causes of death as the basis of an arbitrary division of the table for purposes of comment and comparison ; and separating at the other end of the table the same number of causes, we may conveniently divide the remainder of the table into two other parts, the one comprising 17 causes of death, the other 15 causes. We shall thus have four groups of causes of death, as follows :—

- 1st Group, 15 causes, ranging from 153·97 down to 17·46
- 2nd Group, 17 causes, ranging from 14·75 down to 10·00
- 3rd Group, 15 causes, ranging from 9·88 down to 7·80
- 4th Group, 15 causes, ranging from 7·06 down to 3·50

This division is an arbitrary one, only to be defended on the plea of convenience, but likely to help us in arriving at some definite results.

The first group of 15 causes of death comprises, as has been already stated, all the chief contagious and epidemic maladies—Cholera, Influenza, Small Pox, Scarlatina, Measles, Hooping Cough, Diarrhœa, Typhus Fever, and Erysipelas. It also contains the mixed group of Zymotic Diseases made up of these fatal maladies, and of some smaller groups containing each less than 100 facts ; and that chosen resort of Zymotic Disease, the South District of London. Out of these 15 causes of death, 11 are either individual diseases of the Zymotic class, or the Zymotic group, or the district in which

Zymotic diseases notoriously prevail. Of the four remaining heads, one consists of the deaths returned by the Registrar-General under the designation of "Causes not Specified," another of the somewhat indefinite class designated "Sudden;" the remaining two being the nearly allied diseases—Bronchitis and Asthma.

Of the group headed "Causes not Specified," it may suffice to observe that it presents, in the space of 15 years, irregularities to be accounted for, only on the supposition of a change in the practice of the Registrars, or in the mode of abstracting the facts; though it is worthy of remark that the largest number of deaths under this heading was registered in the year 1854, when the deaths in the Zymotic class were unusually high. The number of deaths registered under the head of "Causes not Specified," in the 15 years beginning 1840, and ending 1854, were as follows:—

260, 233, 236, 212,—105,—86, 86, 61,—115, 135, 150, 164, 170,—271, 275

The deaths entered as "Sudden" present analogous features, due probably to the same cause; and they were also in excess when the deaths under the head of Zymotic diseases were most numerous. The following is the number of sudden deaths in the same 15 years:—

400, 406, 455,—343, 292, 257, 200,—302, 264, 314, 291, 218, 179, 198, 260

The two remaining causes of death comprised in the first group of 15, may, for all practical purposes, be regarded as the same disease under two different names, the fashionable term "Bronchitis" having been largely substituted for the less favourite word "Asthma." The substitution of one for the other is obvious from the following comparison:—

Bronchitis	{	271, 355, 355, 415, 578, 816, 1,154, 1,948, 1,358, 1,425, 1,415
		1,687, 1,552, 2,053, 1,814
Asthma	{	728, 722, 581, 552, 585, 532, 381, 605, 297, 289, 313, 345, 260,
		332, 264

In the one case an increase, subject to considerable fluctuations, from 271 to 1814; in the other, a falling off subject to similar fluctuations, from 728 to 264! But the most cursory examination of these figures will show that after due allowance has been made for any change in the registration or abstraction of facts, great and striking fluctuations do occur, which are in keeping with what we know of the causes of these two fatal diseases, namely, the degree and duration of cold in the winter season—a cause which is probably nearly as variable in its intensity in different years as the atmospheric states, whatever they may be, which favour the spread of the several epidemic maladies.

From what has been stated, then, it follows that the causes of death characterised by the greatest amount of fluctuation, from

year to year, are the Zymotic Diseases, and the two affections of the chest—Bronchitis and Asthma; the Zymotic Diseases being under the influence of obscure atmospheric changes, the two diseases of the lungs being mainly due to a more appreciable—but still very variable—state of atmosphere, viz., cold.

The second group, of 17 causes of death, is of a more mixed and complex order. At the head of it stand two diseases of a somewhat ill-defined character, namely, Scrofula and Atrophy. A more definite disease, both in its nature and seat, *Tabes Mesenterica*, follows next in order; then Teething; then that symptom and common termination of several fatal maladies, Dropsy. Diseases of the Stomach and Epilepsy complete, with the three last named, a small group of causes of death shewing a fluctuation of upwards of 12 and less than 13 per cent. Deaths from the age of 15 to that of 60 follow next, and then the whole class of diseases of the Organs of Respiration. This compound class presents a lower rate of fluctuation (11·26) than the two diseases, Bronchitis and Asthma, which brought up the rear of the first group of 15, the one with a mean fluctuation of 22·12, the other of 19·47; but still a rate of fluctuation considerably exceeding the rate for all causes, which is 9·51. Diseases of the Lungs, &c., being the residue of Diseases of the Organs of respiration (Bronchitis and Asthma, Phthisis and Croup, being excluded) yield the somewhat lower figure of 10·99, and Inflammation of the Lungs 10·92. This second group of 17 is completed by Childbirth; the age from 60 upwards; Age, in a less defined sense; Thrush, a fatal disorder of infancy; and Rheumatism.

The general results of a review of the first two groups taken together, may be thus briefly expressed :—

The diseases of the Zymotic class are characterised by the highest mean fluctuation; the diseases of the Organs of Respiration (with the exception of Consumption and Croup) are distributed through the first and second groups; and the second group also contains a disease, Rheumatism, greatly affected, as are most diseases of the lungs, by atmospheric changes.

The third group of 15 causes of death, which includes the class of deaths from all causes, consists chiefly of causes of death slightly modified from the average of deaths from all causes, by the introduction of the elements of sex, age, and locality; and in addition to these, of the class of Diseases of the Liver, with a fluctuation of 9·83; Puerperal diseases, &c., with a fluctuation of 9·30; Croup, with a fluctuation of 8·98; Inflammation of the Stomach and Bowels, with a fluctuation of 8·86; and diseases of the Heart and Kidneys, with a fluctuation respectively of 8·02 and 7·80.

The fourth and last group of 15 causes of death presents several points of interest. It embraces the entire class of Diseases of the

Brain and Nerves, with the lowest mean rate of fluctuation (3·50) in the whole table; as well as the residue of the same diseases; and the special diseases, Inflammation of the Brain, Water on the Brain, Paralysis, Convulsions, and Apoplexy, all remarkable for a low figure of fluctuation. This group also comprises the whole class of diseases believed to have a tubercular origin, as well as Pulmonary Consumption and Water on the Brain, members of that class; and Cancer. Scrofula, and Tabes Mesenterica, two other diseases placed by the Registrar-General in the group of Tubercular Diseases, occupy places in the second group, their right to which place will be presently considered. In this last group, too, we encounter the interesting class of Violence, Privation, &c., characterised by the low rate of fluctuation 6·89. The headings not yet noticed, and which serve to complete the group, are Diseases of the Organs of Digestion, Debility from Premature Birth, the mixed group Dropsy, Cancer, &c., and the North District of London—a district characterised, as before observed, by an unusual absence of fluctuation in the deaths which take place within its limits.

I have stated incidentally that I should presently contest the right of two diseases, Scrofula and Tabes Mesenterica, to the high rate of fluctuation given in the table. The ground upon which I make this statement is the striking contrast observable in the number of deaths per million in the first and last years of the series of 15 years. The figures differ so widely as to justify the suspicion that the numbers of deaths returned under these heads have been determined in part, at least, by better medical information, on the part of registrars, or greater care (the result of instructions from head quarters,) and, in some degree, by the changes which have almost imperceptibly taken place in medical nomenclature. As, however, a review of these two diseases, or of any other small number of diseases, simply on the ground that their position in the table, and their separation from other diseases believed to be of the same class, had excited some suspicion of their being wrongly placed, would lay me open to a charge of one-sidedness, I propose to prepare another table in which the average fluctuation shall be restricted to the last 7 years of the 15. By comparing this table with Table II, it will be easy to see what causes of disease are entitled to retain their places, and which of them have probably been influenced by extraneous changes of the kind just referred to.

The more limited term of years will also offer the not inconsiderable advantage of a more ready and more extensive comparison with crime and with other orders of facts subject, in common with disease, to fluctuations in their numbers from year to year.

TABLE IV.

Showing the Fluctuations in the Deaths from Various Causes in the 7 Years
1848—1854.

Cause of Death.		Number of Deaths.	Mean Fluctua- tion.	Mean Fluctua- tion.	Number of Deaths.	Cause of Death.	
1	Cholera	1,619	168·13	2·04	1,014	Dropsy, Cancer, &c.	(55) 62
2	Influenza	98	78·57	3·03	2,634	Diseases of Brain, &c.	(62) 61
3	Small Pox	351	50·14	4·53	1,354	Organs of Digestion	60
4	Scarlatina	1,053	46·72	3·58	395	Cancer	59
5 (6)	Zymotic Diseases....	7,195	45·39	3·58	268	{ Diseases of Brain, &c.	58
6 (11)	South District of London	6,832	35·58	3·60	187	{ (residue) Disease of Kidneys (44) 57	
7 (8)	Diarrhoea	1,037	31·82	4·28	275	{ (residue) Disease of Kidneys	(47) 56
8 (7)	Hooping Cough	863	31·52	4·50	246	Disease of Liver.....	(34) 55
9 (5)	Measles	458	30·79	4·74	873	Disease of Heart, &c.	(46) 54
10 (23)	Age 15 to 60	8,469	19·82	4·80	350	Dropsy	(20) 53
11 (9)	Typhus Fever	1,075	18·51	4·85	232	{ Inflammation of the (57) 52	
12 (15)	Sudden	246	17·89	4·94	4,809	{ Brain Deaths, North District (54) 51	
13	Erysipelas	174	17·24	5·25	4,038	{ of London Tubercular Diseases	(59) 50
14 (33)	Deaths, all causes (Females)	12,428	16·83	5·38	201	Rheumatism, &c.	(31) 49
15 (12)	Asthma	300	16·00	5·54	535	Apoplexy	
16	Deaths from speci- fied causes	25,034	15·68	5·63	610	{ Debility from Premature (56) 47	
17 (38)	Deaths, All Causes ..	25,198	15·67	5·74	958	{ Births Age.....	(29) 46
18 (35)	Deaths at ages 0-15 ..	11,615	14·98	5·75	2,861	{ Pulmonary Consump- (58) 45	
19 (36)	Eastern District of London	5,459	14·82	6·26	642	{ tion Water on the Head	(53) 44
20 (41)	Deaths, all causes (Males)	14,428	14·56	6·35	860	Convulsions	(49) 43
21 (14)	Deaths from causes not specified	183	14·21	6·42	475	Paralysis.....	(52) 42
22 (40)	Deaths, West Dis- trict of London	3,720	13·66	6·76	843	Violence, Privation, &c.	(50) 41
23 (28)	Deaths at age 60 and upwards	4,921	13·22	7·74	198	{ Inflammation of the (43) 40	
24 (10)	Bronchitis	1,619	13·22	7·84	370	{ Stomach and Bowels Tabes Mesenterica.....	(18) 39
25 (19)	Teething	244	12·30	8·13	123	{ Rheumatism, &c. (re- (52) 38	
26 (27)	Child-birth	194	12·28	9·30	283	{ sidue) Puerperal Diseases.....	(40) 37
27 (17)	Atrophy	616	12·17	9·70	165	Scrofula	(16) 36
28 (22)	Epilepsy	144	11·57	9·70	146	Croup.....	(42) 35
29 (30)	Thrush	72	11·04	9·75	123	{ Diseases of Stomach (21) 34	
30 (24)	Organs of Respira- tion	3,768	10·60	9·91	1,508	{ (residue) Inflammation of Lungs (26) 33	
31 (39)	Deaths, Central Dist. of London ..	4,125	10·39	9·94	181	{ Diseases of Lungs (re- (25) 32	
						{ sidue)	

The first circumstance which claims attention in this table, as compared with Table III, is the greatly increased rate of fluctuation prevailing during the shorter period of 7 years in the deaths from all causes, and in the several smaller groups formed out of this principal group, by introducing the elements of sex, age, and locality. The group of deaths from All Causes, instead of being the 38th in Table III, is the 17th in Table IV, and the smaller groups just specified

are found to undergo a similar change of place. This change is fully accounted for by the occurrence, within this septennial period, of two outbreaks of Asiatic Cholera. This same circumstance explains the higher position in the table occupied by the class of Zymotic diseases; the deaths in that home of Zymotic diseases, the South District of London; and the much higher place taken by deaths between the ages of 15 and 60, when this class of diseases is known to be peculiarly prevalent.

Of this class of Zymotic diseases it will suffice to state that their place in the table has undergone little alteration. Cholera, Influenza, Small Pox, and Scarlatina, retain their places, the first with increased, the last three with diminished, fluctuation; while Diarrhœa, Hooping Cough, Measles, Typhus Fever, and Erysipelas, undergo, with the exception of the last-named, some change of position.

Asthma occupies a somewhat lower place, and is separated from Bronchitis by seven groups headed by deaths from all causes, the remainder being formed from that larger group by the introduction of the elements of sex, age, and locality. Diseases of the Organs of Respiration, Diseases of the Lungs (residue), and Inflammation of the Lungs, are degraded from their high position in Table III, in consequence chiefly of the intrusion of the larger groups (deaths from all causes, &c.) just referred to. But they continue to occupy a second place to the class of Zymotic diseases.

Scrofula and Tabes Mesenterica, (diseases classed in the returns of the Registrar-General with Pulmonary Consumption and Water on the Brain as "Tubercular Diseases,") will be found, as I had anticipated, to have undergone a great change of position. Scrofula, from being 16th in Table III, is 36th in Table IV, and Tabes Mesenterica, which held the 18th place in Table III, holds the 39th in Table IV. On the other hand, in consequence of Pulmonary Consumption and Water on the Brain taking a higher place in Table IV, the several members of this mixed class of Tubercular diseases are much nearer to each other.

Dropsy is another disease, or, to speak more justly, a symptom of several fatal maladies, which has undergone a very great displacement. Instead of being 20th in Table III, it has fallen to No. 53 in Table IV, coming next in order to Diseases of the Heart, Liver, and Kidneys, of which it is so common a consequence, Diseases of the Liver having fallen from the 34th to the 55th place, as if to vindicate their alliance with Dropsy. Diseases of the Brain occupy the last place but one in Table IV, instead of the last place in Table III, and the Special Diseases of the Brain, (Inflammation, Apoplexy, Convulsions, and Paralysis, together with Water on the Brain,) are all to be found in the portion of the table occupied by diseases of a low rate of fluctuation. Cancer takes a still lower place than in Table III,

and ranks among the diseases characterized by a very low rate of fluctuation.

On the whole it may be safely affirmed of Table IV, that it is, to a great extent, confirmatory of the results obtained in Table III, while it corrects some errors of position arising out of the changes in registration due to the lapse of time, the alterations which have taken place in medical doctrines and nomenclature, and the considerable improvements brought about in medical diagnosis.

If now we omit from Table IV all the general headings, and retain only well-defined diseases, as is done in the next table (Table V) it will be possible to arrive at some general conclusions worthy of note. With a view to simplicity, the numbers of the facts are omitted, and the rate of fluctuation is expressed in the round numbers most nearly approximating to the true figures.

TABLE V.
Special Diseases only.

Cause of Death.	Fluctuation.	Cause of Death.	Fluctuation.
1. Cholera	168	14. Inflammn. of Lungs	10
2. Influenza	79	15. Croup	10
3. Small Pox	50	16. Scrofula	10
4. Scarlatina	47	17. Tabes Mesenterica..	8
5. Diarrhoea	32	18. Paralysis	6
6. Hooping Cough	32	19. Convulsions	6
7. Measles	31	20. Water on the Brain	6
8. Typhus Fever.....	19	21. Pulmonary Con- sumption	6
9. Erysipelas	17	22. Apoplexy	6
10. Asthma	16	23. Inflammation of the Brain	5
11. Bronchitis	13	24. Cancer	4
12. Epilepsy	12		
13. Thrush	11		
Violence, Privation, &c..... 7.			

The inferences to be drawn from this table are, perhaps, best expressed by resolving it at once into the elements of which it seems to consist.

1. In the first place, we have all the diseases of the Zymotic class, except Thrush, comprised in the first 9 members of the table. The rate of fluctuation of this important class of diseases ranges from 168 down to 17, the exceptional disease, Thrush, having the lower rate of 11.

2. The second place is occupied by the four diseases of the organs of respiration—Asthma and Bronchitis, Inflammation of the Lungs and Croup ; of which the first two are separated from the last two by the intervention of Epilepsy and Thrush. These diseases of the organs of respiration have a rate of fluctuation ranging from 16 down to 10.

3. The remaining diseases consist of two classes interwoven, so to speak, the one with the other, and having jointly a rate of fluctuation ranging from 10 down to 4. The one class consists of the diseases traceable to tuberculous or other degeneration of the textures of the body, and comprises Scrofula, Tabes Mesenterica, Water on the Brain, and Pulmonary Consumption; the other class includes Paralysis, Convulsions, Apoplexy, and Inflammation of the Brain. The first class presents a range of fluctuation from 10 down to 6; the second class, the more limited range, from 6 to 5. To the second class belongs the exceptional disease, Epilepsy, with a fluctuation of 12; to the first class may be assigned, as having a remote relationship to its other members, Cancer, with the low fluctuation of 4.

4. The deaths due to Violence, Privation, &c., in the bringing about of which the human will bears a prominent part, have a fluctuation of 7, and would find their proper place towards the end of the table, occupying the 18th place in 25 places.

To make this short summary complete, it is only necessary to add that the best defined classes of disease—Diseases of the Brain, of the Alimentary Canal, of the Liver, of the Heart, of the Kidneys—are all to be found in Table IV, in that part of the table which exhibits the lowest rates of fluctuation, namely from 2 to 5 per cent.

The foregoing inferences admit of being compressed into the following short proposition:—

The highest rate of fluctuation belongs to diseases of the Zymotic class; an intermediate rate to diseases of the organs of respiration; the lowest rate to other local diseases, including those which consist in a degeneracy of the textures of the body; and a low rate of fluctuation to that class of deaths in which human volition plays a principal part.

Or, if causes may be substituted for effects, the proposition will assume this shape:—The causes which give rise to epidemic maladies are subject to great variations of intensity from year to year; those which occasion diseases of the organs of respiration are less variable in their operation; while the changes that take place within the body itself, and issue in the production of fatal local diseases, display an extreme degree of steadiness and uniformity.

It has been already stated, more than once, that the mixed group of causes of death, headed Violence, Privation, &c., in the production of which the human will plays so conspicuous a part, presents a very moderate amount of fluctuation. It will be interesting to inquire whether this moderate rate of fluctuation also obtains in the returns of deaths from causes more or less completely within the control of the human will; whether in the shape of homicide or suicide, or as the result of a neglect more or less deliberate of due precaution against accident. The facts of this order, which are best obtained from the Registrar General's returns for all England, are

embodied in the following table. In using this table, it is necessary to premise that the annual figures are not corrected for increase of population, and that they relate to the deaths of males only.

TABLE VI.
Violent and Accidental Causes of Death in England.—7 Years, 1848-1854.

Cause of Death.	Number.	Fluctuation.	Cause of Death.	Number.	Fluctuation.
Intemperance	232	12·43	Fractures and Con- tusions	4,008	6·07
Drowning	2,012	8·45	Wounds	482	5·12
Poison	235	7·80	Delirium tremens ...	517	5·06
Hanging and Suf- focation	825	6·34	Burns and Scalds ...	1,312	3·96
Violence, Privation, &c., being the aggregate of the above.... 3·44					

The highest amount of fluctuation shown in this table—that of intemperance—falls short of the fluctuation in most Zymotic maladies. With the single exception of intemperance, too, the rate of fluctuation is lower than that of the principal diseases of the organs of respiration (Consumption excepted); while the lower rates of fluctuation are such as we meet with in diseases characterized by the greatest steadiness, from year to year.

I now proceed to the second division of this Paper, in which I propose to compare the Fluctuations in Disease with the Fluctuations in Crime, and in other events within and beyond the control of the human will.

The facts which I shall use to illustrate the Fluctuations in Crime are contained in a return of the “Number of Persons taken into Custody by the Metropolitan Police, and the Results in the year 1855, with Comparative Statements from the year 1831 to 1855 inclusive.” This return embraces the 15 years from 1840 to 1854, in respect of the leading results of the apprehension of offenders; and it also presents for each of the 7 years 1848 to 1854, the number of persons committed for trial or bailed, under certain general heads, or classes, of crime. I shall also make use of the similar facts for the whole kingdom contained in Mr. Redgrave’s last return.

I begin my comparison of disease and crime by presenting, in a tabular form, the leading results of the apprehension of some 60,000 persons, brought before the Police Magistrates of the Metropolis every year. After calculating the mean annual rate of fluctuation in the numbers representing these results, in the same way as in the case of the diseases proving fatal to the same population, I shall place the figures representing the fluctuations in question in juxta-

position with the fluctuations in the same mean number of deaths from various causes; or, where an equal number of facts is not to be obtained, the nearest approach to the mean number which the tables of mortality supply.

The following table presents the results of this comparison:—

TABLE VII.
Comparison of Disease and Crime (The Metropolis)—1840–1854.

DEATHS.			CRIMES,		
Causes of Death.	Number of Deaths.	Fluctuation.	Fluctuation.	Number of Cases.	How disposed of.
Deaths from all causes	24,864	9·51	4·81	28,306	{ Summarily disposed of, or held to bail.
„ 60 and upwards	4,987	10·84	7·60	4,710	{ Committed for trial.
„ North Districts	4,670	5·67			
„ Central Districts.....	4,402	9·45			
„ from Tubercular Diseases.....	4,427	4·25			
„ West Districts.....	3,676	8·49	8·06	3,654	{ Convicted and sentenced.
„ from Diseases of Organs of Respiration }	3,747	11·26			
„ from Pulmonary Consumption.....	3,230	4·45			
„ from Diseases of the Heart, &c.....	785	8·02	9·92	722	Acquitted.
„ from Diarrhoea	747	29·45			
„ from Cholera	780	153·97			
„ from Water on the Brain	767	6·00			
„ from Puerperal Diseases, &c.....	280	9·30	12·82	283	{ Bills not found, or not prosecuted.
„ Sudden	292	17·46			
„ from Inflammation of the Brain	280	5·00			
„ from Disease of the Lungs, (residue) }	282	10·99			
Births	32,028	1·95	3·66	34,598	{ Discharged by the Magistrate

In this table we have as fair a comparison as the nature of the case allows between deaths from disease, which are to a great extent beyond human control, and the issue of cases brought before the Police Magistrates for adjudication. Both classes of facts are remarkable for the number of concurrent causes which must have conspired to bring about each distinct event. In deaths from disease there are influences prior to birth determining the peculiar constitution of each individual; influences within and beyond his

will, affecting him during the whole course of his life; and causes acting with greater or less force to determine the result of his last illness. On the other hand, the events recorded on the other side of the table have been similarly influenced by the original character of the persons who have actually committed crime, by their education and acquired habits, their position in life, and the society in which they have been placed. The number of persons taken into custody is further influenced by the efficiency of the police, and the disposal of them by the evidence which happens to be forthcoming, and the effect of that evidence on the mind of the magistrate. So that this table presents, in striking contrast, two series of events, each brought about by the successive or simultaneous operation of a great number of causes, chiefly physical in the one case, chiefly moral in the other; and we find (contrary to what we should probably, all of us, have concluded *à priori*) that the events brought about by the co-operation of moral causes are as free from fluctuation as the events determined by the joint operation of physical causes. For while the mean fluctuation for crime ranges from 4·81 to 12·82, the range of fluctuation for disease is from 4·25 to 153·97, or, excluding this last figure, as belonging to Asiatic Cholera, from 4·25 to 29·45. It is also worthy of remark that the highest fluctuation for crime (12·82) is exceeded by the rate of fluctuation of all the Zymotic diseases, with the exception of Thrush, by the rate of fluctuation in Bronchitis and Asthma, and in no less than five other less distinctly defined causes of death. (See the first 17 causes of death in Table III.) Five other causes of death also exhibit nearly the same amount of fluctuation; so that in 22 out of 62 instances the fluctuation in disease surpasses, or nearly equals, the fluctuation in the facts representing the disposal of criminals.

It may be stated, therefore, in general terms, that the rate of fluctuation due to the concurrent operation of a large number of moral causes, falls short of the fluctuation observed in the class of Zymotic diseases, in which the most variable and obscure of atmospheric influences is brought to bear on the human body, already largely affected by the operation of other physical causes, whether within itself or external to it.

The comparison made at the foot of the table, between the fluctuation in the number of births and the fluctuation in the number of persons discharged by the magistrates, shows a less degree of steadiness in the latter class of facts, but still a small amount of fluctuation, which approximates very closely to the fluctuation (3·75) in the case of marriages.

I now proceed, by means of a table constructed in the same manner as Table VII, but based upon 7 instead of 15 years, to contrast deaths from disease with the committals for trial and with the committals for certain distinct classes of crime.

TABLE VIII.
Comparison of Disease and Crime. (The Metropolis.) 7 Years—
 1848-1854.

DEATHS.			CRIMES.		
Causes of Death.	Number of Deaths.	Fluctuation.	Fluctuation.	Number of Crimes.	Nature of Crimes.
Asthma	300	16.00	13.61	301	Offences against the person.
Sudden	246	17.89	12.83	248	Offences against property with violence. Forgery and offences against the currency.
Teething	244	12.30		245	
Diseases of Liver.....	246	4.74			
Deaths, West District	3,720	13.66	5.48	3,860	Offences against property without violence.
Organs of Respiration	3,768	10.60	7.31	3,841	Convicted and sentenced.
All causes	25,198	15.67	4.16	36,400	Discharged by the Magistrates.
			3.21	30,237	Summarily disposed of or held to bail.
Deaths at age 60 and upwards	4,921	13.22	7.01	4,728	Committed for trial.
Deaths in North District	4,809	4.97			
Water on the Brain.....	642	6.26	9.28	711	Acquitted.
Erysipelas	174	17.24	12.59	175	Bills not found, or not prosecuted.
Child-birth	194	12.28			
Diseases of Lungs (residue)	181	9.94			
Scrofula	165	9.70			
Inflammation of Stomach and Bowels	198	7.74			
Diseases of Kidneys (residue)	187	4.28			

In this table the mean annual fluctuation in crimes, and in the issue of cases brought before the magistrates, ranges from 3.21 to 21.84; while the mean annual fluctuation in the causes of death selected for comparison has a somewhat more limited range, from 4.28 to 17.89. Nevertheless, it will be observed that this highest rate of fluctuation attained by crimes, and shown in the issue of cases brought before the magistrates, falls short of the rate of fluctuation in the case of all the more important diseases of the Zymotic class. Cholera, Influenza, Smallpox, Scarlet Fever, Hooping Cough, and Measles, all show a rate of fluctuation greatly in excess of the high rate of 21.84;

which marks the criminal class of forgery and offences against the currency. The rate of fluctuation in Measles, which stands at the bottom of this short list of Zymotic maladies, is in round numbers, 31; the rate of fluctuation in the class of offences just named being 22.

I now proceed to compare the criminal returns for all England with disease, as it affects the whole country. In making this comparison, I shall not introduce any correction for increase of population; I shall contrast, as in the last table, equal, or nearly equal, numbers of crimes and of deaths from disease; and I shall arrange the facts in the order of the magnitude of the fluctuation in the column of crimes.

TABLE IX.
Disease and Crime.—England.—7 Years, 1848-54.

DEATHS.			CRIMES, &c.		
Causes of Death.	Number of Deaths.	Fluctuation.	Fluctuation.	Number of Crimes.	Nature of Crimes, &c.
Purpura and Scurvy....	263	5·51	22·44	251	{ Malicious offences against property.
Mortification	1,300	7·13	20·05	1,266	{ Offences against Mutiny Act.
Disease of Spleen.....	61	14·20	18·49	58	{ Sentenced to death.
			17·77	788	{ Miscellaneous.
Malformations.....	821	5·38	8·25	794	{ Forgery and offences against the currency.
			9·54	2,053	{ Offences against the person.
Erysipelas	2,136	8·45	5·44	1,966	{ Offences against property, with violence.
Scarlatina	16,249	19·65	8·01	16,199	{ Committed to same prison once.
Zymotic Diseases	98,397	26·27			
Tubercular Diseases ..	65,660	4·90	7·34	76,280	{ Summarily convicted.
			6·75	10,665	{ Remanded and discharged.
Dropsy.....	10,124	3·96	4·13	9,362	{ Committed to same prison four times.
Hooping Cough	8,736	18·07	5·48	8,657	{ Debtors and civil process.
			4·92	3,742	{ Want of sureties.
Disease of Liver	3,796	3·81	3·19	3,752	{ Committed to same prison three times.
Age	26,637	4·99	4·67	28,123	{ Commitments.
Measles	6,971	33·90	4·52	7,088	{ Committed to the same prison twice.
Pneumonia	22,057	5·35	3·38	22,270	{ Offences against property without violence.

This table agrees with Table VII, in assigning to deaths from disease a higher fluctuation than to crime and the disposal of criminals. In Table VII, the highest rate for crime is exceeded by the highest rate for deaths by disease in three instances, in Table IX in two instances. In Table IX, however, there are a greater number of instances in which the rate of fluctuation for crime exceeds the rate of fluctuation for the diseases compared with it than in Table VII.

But if we strike an average of the rates of fluctuation for crime and for disease, in the three Tables VII, VIII, and IX, we find that they agree in giving for crime a lower rate of fluctuation than for deaths by disease, in the proportion of 9, 10, and 9, to 19, 11, and 12; or (excluding Cholera from Table VII) 9, 10, and 9, to 10, 11, and 12. There is reason, therefore, to believe that, taking the facts relating to crime one with another, they display a lower rate of fluctuation than deaths from disease, the two orders of facts being compared in nearly equal numbers, so as to eliminate the fallacy attaching to the use of unequal aggregates of facts. It is also worthy of remark, that the rate of fluctuation for the facts relating to crime is still inferior to the rate of fluctuation for deaths from diseases belonging to the Zymotic class. The highest rate for crime, (22·44 in malicious offences against property) is less than the average for Zymotic diseases (26·27), and, therefore, considerably below the rate for several members of that class.

The smallness of the annual fluctuation in the numbers of crimes, as compared to the fluctuation in the numbers of deaths, is not now stated for the first time; for Mr. Samuel Brown, in a valuable Paper "On the Uniform Action of the Human Will, as exhibited by its Mean Results in Social Statistics," (*Assurance Magazine*, vol. ii., p. 320,) says, "that from the slightest tendency to crime to the most depraved inclination of the human heart, certain laws may be deduced by which, in a large population, their recurrence may be predicted with greater certainty than the laws of disease and death."

Such being the result of a comparison of deaths by disease with crimes and the leading facts relating to them, I now come to consider the third subject embraced in the title of this paper, namely, the fluctuations prevailing in other events within and beyond the control of the human will.

Now, it is obvious that the numerical facts relating to matters altogether beyond the control of the human will are very few in number. The voluntary antecedent of marriage influences the number of births; the habits of life in which men indulge bear their part in determining the number of deaths. With the exception perhaps of the weather, and of those phenomena of the external world which admit of being expressed in the simple language of figures, there is no order of facts embodied in our numerous and multifarious numerical returns, from which the operation of the human will is wholly excluded. It will be necessary, therefore, to make choice of the weather, as affording data for determining the rate of fluctuation of events brought about by causes wholly beyond the control of the human will, and to compare some of the constituent elements of that proverbially fickle and variable thing with disease on the one hand, and crime on the other. Such a comparison can only

be made by treating fractional parts of a degree of temperature, or of an inch of rain, as equivalent to units of disease or crime. If the propriety of this procedure is admitted, we shall be in a condition to compare disease on which the human will has little direct influence; and crime, in which the human will is of paramount importance, with the weather, from which the operation of the human will is altogether excluded. This comparison is made in the following table:—

TABLE X.—*The Weather compared with Disease and Crime.*

The Weather.	Number of Units.	Fluctuation.	Disease.	Number of Deaths.	Fluctuation.	Crime, &c.	Number of Crimes.	Fluctuation.
Mean Annual Temperature of the Air in 10ths of degrees (15 years)	492	2·38	Apoplexy	524	7·06	Acquitted	722	9·92
Annual Rain Fall in 10ths of inches (15 years)	242	28·51	{ Diseases of the Liver }	241	9·83	{ Bills not found or not prosecuted }	283	12·82
Horizontal movement of the Air in miles (7 years)	742	14·49	{ Water on the Brain }	642	6·26	Acquitted	711	9·28

The small number of facts at my command has prevented me from comparing equal, or nearly equal, numbers of units with each other; but I have made use of the numbers most closely approximating to an equality.

The inferences to be drawn from the figures in this table are:—1. That of the three elements which make up what is commonly called the weather, the temperature exhibits the least, and the rainfall the greatest, amount of annual fluctuation; the wind occupying an intermediate position. 2. That the annual fluctuation in the case of the temperature of the air, falls short of the annual fluctuation in the diseases, and in the issue of cases taken into custody, which happen to be selected for comparison. 3. That the highest fluctuation, namely that in the fall of rain, though considerable, still falls short of the fluctuation which obtains in the case of the leading Zymotic maladies.

The events, other than those already examined, which may be said to be within the control of the human will, constitute the bulk of the numerical returns that form the staple of our blue books, with the single exception of returns relating to deaths, and the causes of death; though the human will, as already stated, is not wholly excluded even from the causation of this latter order of facts.

The events which have now to be examined, may be said to represent the operation of the human will in every possible degree of

intensity, and in every possible combination of motive. Every single event, without exception, represents the ultimate effect of a long succession of antecedents; of an active, though unconscious, co-operation of a vast number of voluntary agents, making use of the powers and products of nature, which are themselves subject to the utmost variety, in respect of intensity and abundance.

The price of provisions, for example, may be said to be the ultimate result of the joint operation, simultaneous or successive, of an unusually large number of causes:—of the demand as determined by the paying power of the community; of the more or less abundant supply as influenced by the industry, capital, and skill of the producer; the enterprise of the merchant; the cost of freight; the facilities of transport by land and sea; the state of peace or war; the more or less favourable nature of the seasons at home and abroad; fiscal facilities or impediments; and the abundance or scarcity of other articles of diet. In like manner, the prices of stocks and shares; the produce of mines and collieries; the value of exports and imports; the number and tonnage of vessels; the number of emigrants; the consumption of commodities;—all are aggregate results of an almost infinite series of combinations and permutations of human wants creating a demand, of human industry and enterprise affording a corresponding supply. Not less numerous are the causes which conspire to determine the annual number of bankruptcies; of fires and alarms of fires; of students in search of education; of paupers seeking relief at the cost of the state; of proposals for life-assurance; of persons tempted to the commission of suicide; of letters distributed by the post-office. It may not be easy in every case to sum up all the moral and physical forces which combine to bring about each individual event in the aggregate of events, or to render a reasonable account of the rate of fluctuation which belongs to each collection of facts; but it is easy to see that every order of facts contained in the several tables of this Essay is marked by the common property of being dependent upon the combined operation of a great number of causes bearing on each individual event with a very variable intensity. This is the peculiar feature which marks all the facts with which the Statist has to deal, so that his science may be said to be the science which takes cognizance of all that large class of facts and events which, resulting from the combined operation of a great number of causes, express themselves in the language of numbers.

As I have mentioned particularly the price of provisions, I will begin by making this the subject of comparison with disease and crime, similar to the comparison instituted in the last table for the leading constituent elements of the weather. I select, as sufficient for my purpose, the prices of the three cereals—wheat, barley, and oats—expressed in pence, for each of the fifteen years, 1840 to 1854 inclusive.

TABLE XI.
Prices of Cereals compared with Disease and Crime.

Nature of Crime, &c.	Number of Crimes.	Fluctuation.	Species of Grain.	Average Number of Pence.	Fluctuation.	Causes of Death.	Number of Deaths.	Fluctuation.
Miscellaneous	788	17.77	Wheat	643	12.70	Measles	575	41.74
Forgery, and offences against the currency (England)	794	8.25				Diarrhoea	747	29.45
						Dropsy	588	12.41
						Diseases of the Heart, &c.	715	8.02
						Violence, Privation, &c.	769	6.89
						Water on the Brain	767	6.00
Offences against the person (London)	301	13.61	Barley	379	14.23	Small Pox	399	69.92
						Teething	325	12.48
						Inflammation of the Stomach and Bowels	316	8.86
						Cancer	349	6.60
						Sudden	292	17.46
						Diseases of the Lungs (residue)	282	10.99
						Diseases of the Liver	241	9.83
						Puerperal Diseases, &c.	280	9.30
						Diseases of the Kidneys	231	7.80
Malicious offences against property (England)	251	22.44	Oats	257	19.50	Inflammation of the Brain	280	5.00
						Diseases of the Brain and Nerves (residue)	264	4.16

With so many variable causes co-operating to bring about one result, it can excite no surprise that the price of food should fluctuate from year to year, to the extent indicated in the table; that it should present the same sort of fluctuation as the crimes with which it is compared; and that it should exceed in amount the fluctuation in the numbers of deaths from most diseases. But it is worthy of remark, that large as is this fluctuation, it still falls short of that which obtains in the case of diseases of the Zymotic class. It is such a fluctuation as occurs in the more variable elements of the weather; it is such as takes place in the diseases most affected by atmospheric influences; it exceeds the rate of fluctuation in events brought about exclusively, or chiefly, by the operation of the human will; but it falls greatly short of that high rate of fluctuation which results from the operation of the causes, whatever they may be, which give rise to epidemic maladies.

The series of comparisons which I am now instituting would be incomplete, if I did not add to the weather and the prices of commodities, the prices of the funds and principal stocks; for there is no order of facts which acknowledges as its cause, a more variable combination of moral forces. I use, for the purpose of comparison, the highest and lowest prices of Consols, and of Bank and of India Stock, expressed in eighths of a pound, for the 7 years 1848-54, comparing them, as in the previous tables, with as many deaths from disease, and as many crimes or disposals of criminals, as there are units of money.

TABLE XII.—*Prices of Stocks compared with Disease and Crime.*

CRIME.	Number of Crimes.	Fluctuation.	STOCKS.				DISEASE.	Number of Deaths.	Fluctuation.
Forgery and offences against the currency (England)	794	8.25	{ Consols, highest 781 2.92 } ,, lowest 723 4.93 }				{ Water on the } { Brain }	767	6.00
Offences against property with violence (England)	1,966	5.44	{ India stock, highest 2,115 5.92 } ,, lowest 1,945 5.75 }				{ Inflammation } { of the Lungs }	1,740	10.92
Offences against the person (England)	2,053	9.54	{ Bank stock, highest 1,739 3.68 } ,, lowest 1,622 3.66 }				Bronchitis.....	1,619	13.22

This table places, in a very striking light, the steadiness of the funds and leading stocks, when compared with disease and crime. The rates of fluctuation for Consols and for India and Bank Stock are comprised between the low figures 2.92 and 5.92—figures lower,

with one exception, than the rates of fluctuation brought into comparison with them.

It now only remains for me to complete this inquiry, in accordance with the title of the paper, by bringing together into a single tabular view the miscellaneous facts which I have collected, in further illustration of the rate of fluctuation in events brought about by the combined operation of a great variety of causes.

TABLE XIII.
Miscellaneous Events and Facts.

	Number of Events or Facts.	Fluctuation.
1. Bankruptcies (15 years)	1,609	18·64
2. " (7 ")	1,505	24·54
3. Emigrants from the United Kingdom (7 yrs.)	312,361	10·84
4. Fires in London (7 years)	888	3·83
5. Fires and alarms of fire (7 years)	1,072	5·00
6. Students at King's College (exclusive of evening classes (7 years, 1851-57)	1,025	7·13
7. Students registered at College of Surgeons (7 years, 1851-57)	1,073	1·85
8. Sailing-vessels employed in the Home and Foreign Trade (6 years, 1849-54)	17,440	2·21
9. Ditto, tonnage.....	3,246,782	3·26
10. Ditto, men	144,331	6·25
11. Steam-vessels employed in same way for same period (exclusive of river steamers)....	514	12·70
12. Ditto, tonnage.....	158,976	15·45
13. Ditto, men	12,416	17·23
14. Sailing and steam-vessels (total of foregoing)	17,955	2·42
15. Ditto, tonnage.....	3,405,759	3·73
16. Ditto, men	156,747	6·55
17. Sailing-vessels built and registered in the United Kingdom (7 years, 1848-54)	641	5·38
18. Ditto, tonnage.....	126,155	9·73
19. Steam-vessels.....	108	23·45
20. Ditto, tonnage	29,764	27·19
21. Sailing and steam-vessels (total of foregoing)	750	6·78
22. Ditto, tonnage	155,919	10·26
22. Declared value of articles exported from ports in the United Kingdom (1848-54)	1,409,414	12·31
23. " " Coals and culm		
24. " " Cotton manufactures....	22,321,161	7·68
25. " " Hardware and cutlery	2,822,165	13·46
26. " " Woollen manufactures	8,295,193	11·68
27. " " Machinery.....	1,270,974	19·10
27. Articles (paying duty) retained for home consumption in the United Kingdom (1848-54) Coffee (lbs.).....	34,922,900	5·77
28. " " Raw sugar (cwts.)	6,653,354	6·16
29. " " Tea (lbs.)	54,196,841	4·06
30. " " Tobacco, manufactured (lbs.)	28,168,964	1·89
31. " " Wine (galls.)	6,434,481	2·66
32. Produce of British mines (1848-54) Tin (tons)	6,349	5·25
33. Sales from Cornish copper mines (Tons of ore)	161,690	5·07

TABLE XIII.—*Continued.*

	Number of Events or Facts.	Fluctuation.
34. Paupers (exclusive of vagrants) in receipt of relief Jan. 1 (1849-54) (In-door)	112,129	4.40
35. Ditto (Out-door)	749,110	3.45
36. Ditto (Total)	861,239	3.60
37. British vessels entered in ballast (1848-54) (tons)	4,921,869	3.43
38. Ditto cleared	4,966,996	2.46
39. Foreign vessels entered in ballast	2,851,035	6.77
40. Ditto cleared	3,115,245	9.32
41. British and foreign (total of foregoing) entered (tons)	7,772,905	5.20
42. Ditto cleared	8,082,241	3.56
43. Vessels wrecked per 1,000 registered (1844-51, except 1846)	232	10.34
44. Suicides in London (5 years 1846-51) men	164	7.93
45. " " women	78	9.25
46. Letters by London District Post (1848-54) estimate	39,502,576	5.43
47. " " England and Wales estimate	297,743,483	5.48
48. Proposals to Eagle Insurance Company (1848-54)	307	8.52
49. Ditto, completed	251	6.44

To the miscellaneous collection of facts comprised in this table, the same observations apply as to the facts relating to mortality and crime. There are examples of a high, as well as of a low, rate of fluctuation; the very highest (namely, the tonnage of steam vessels built and registered in the United Kingdom—27.19) falling short of the rate of fluctuation in the leading Zymotic maladies; the lowest (namely, the number of students registered at the College of Surgeons in the class of anatomy, and the number of pounds of manufactured tobacco entered for home consumption—1.85 and 1.89, respectively) falling even lower than the low fluctuation of births in London.

The higher rates of fluctuation in this table cannot fail to attract attention, as belonging to things in a state of rapid increase from year to year. Thus, the tonnage of steam-vessels built and registered in the United Kingdom, presents an average rate of fluctuation 27.19, and the number of such vessels a rate of 23.45. So also with steam vessels employed in the home and foreign trade; there is a fluctuation of 17.23 in the men by whom they are manned, of 15.45 in the tonnage of the vessels, and of 12.70 in the number of the vessels. Another high rate of fluctuation (19.10) is observed to belong (partly for the same reason) to the exports of machinery. On the other hand, the rate of fluctuation is moderate, or even of very small amount, in the case of sailing vessels, and of the aggregate of sailing vessels and steamers.

The lower rates of fluctuation, too, are deserving of notice, from the near approach to equality of the rates of fluctuation of facts of a totally different order. But to this subject I shall have to refer again, presently.

With the exception of the cases of high rates of fluctuation just referred to, the events which exhibit the highest rate are bankruptcies. For the seven years, 1848-54, they fluctuate as the numbers 24·54—numbers in excess of the rate (21·84) for forgeries and offences against the currency, in London, in the same seven years.

I have now, by the aid of a larger and more varied assortment of facts than has hitherto been employed for the purpose, and making use of the deaths from various causes (on account of their being almost independent of human volition) as a starting point and standard of comparison, brought under the notice of the society a subject of great interest and of some practical utility. The numerical method, or the science of large numbers, treats of no topic more interesting than this. No one who has to deal with large numbers of facts, or to make up periodical returns of figures, can fail to be struck with the remarkable recurrence, year by year, of aggregates of similar amount, whether the figures relate to births, deaths, and marriages, to crimes and the sentences of criminals, to the weather, to the prices of stocks, to the production, consumption, and price of food or manufactures, to the number of vessels employed in the work of import and export, to the numbers of fires and wrecks, of paupers and bankrupts, or to the number of qualified persons who year by year recruit the ranks of the learned professions. In every considerable collection of facts there are to be found many examples of a degree of steadiness and freedom from fluctuation which could not have been anticipated, and which experience alone could have taught us to look for. Those writers, too, who have treated of these fluctuations as phenomena belonging to the logic of large numbers, have always spoken of them with surprise and admiration, sometimes even with a feeling approaching to awe. Quetelet, for instance, speaks of the striking resemblance between the numerical expression given to events brought about by the human will, and by physical forces over which man has no control, as afflicting. "It must be confessed," he says, "that distressing as the truth at first appears, if we submit to a well followed out series of observations, the physical world and the social system, it would be difficult to decide in respect to which of the two the acting causes produce their effects with most regularity."* This distinguished statist, by speaking of this coincidence as distressing at the first view of it, means perhaps to have it understood that a more careful considera-

* Sur l'Homme, et le Développement de ses Facultés. Par M. A. Quetelet. Conclusions, book iii., chapter 3.

tion divests the facts of the painful aspect which they wear at first sight; but as this is rather inferred than distinctly expressed, it may be well to enquire whether there is, or is not, any good and sufficient ground for regarding these curious coincidences with suspicion.

Now it is quite clear that the origin of any painful feeling to which the coincidences in question may give rise is to be traced to a misgiving, lest the human will, instead of continuing to be looked upon as an independent movement of the mind, swayed by reason and conscience, should come to be regarded as on a par with such unconscious forces as the winds and waves, the weather and the seasons, the causes of shipwrecks and of deaths. Under the influence of this misgiving the mind seems to be drifting towards fatalism, and can only save itself by a strong effort of reason. The reality of the coincidences which have given rise to the misgiving is admitted; how then is the difficulty to be explained away?

In the first place, it must be evident, on the most superficial consideration of the facts, that the recurrence, year by year, of the same or similar numerical values, as the ultimate result of the simultaneous or successive operation of a number of forces, does not enable us even to guess at the nature or degree of those forces. The very same figures may result, now from physical, now from moral causes; at one time from forces of great intensity, at another from forces of the most trivial character. As illustrations of equal amounts of fluctuation from totally dissimilar causes, take the deaths in the West District of London in seven years, (fluctuation 13·66) and offences against the person (fluctuation 13·61), or deaths from apoplexy (fluctuation 5·54), and offences against property without violence (fluctuation 5·48), or students registered at the College of Surgeons (fluctuation 1·85), and the number of pounds of manufactured tobacco taken for home consumption (fluctuation 1·89), or out-door paupers (fluctuation 3·45), and tonnage of British vessels entered in ballast (fluctuation 3·43): and as illustrations of nearly equal numerical results brought about by moral forces of some intensity, and of physical forces of the most trivial order, take the experiments detailed in a paper read before the Institute of Actuaries, and published in the fifth volume of their transactions, p. 315. As this paper may not have fallen under the notice of the Members of this Society, I may briefly state that the experiments consisted in substituting for men and women, or for consumptive and non-consumptive patients, presenting themselves in the out-patient department of King's College Hospital, in groups of 25 and 50, an equal aggregate, in the ascertained proportions of men to women, and of the one class of patients to the other, of black and white peas drawn out of a bag in numbers equal to the groups in question. Between the attendances determined, as they must have been, by a

great variety of motives, and the drawings effected by variable combinations of very trivial forces, there were several remarkable coincidences. The figures were nearly the same, but the forces wholly different in degree and in kind. If these concurrent forces, so contrasted in character and so different in intensity, may find their ultimate expression in precisely the same figures, what ground can there be for inferring from equality of numbers identity of character? And yet such an inference as this must have lain at the root of Quetelet's misgivings. Had he entered deeper into the subject, and accumulated a greater number and greater variety of instances, he must have been completely re-assured, and he would either not have given expression to his mistrust, or he would have shown his readers how he had contrived to divest himself of that painful feeling in his own case.

The fact is, that all analogy sets itself against the attempt to infer the nature of a cause from the figures which measure its intensity. We continue to be as ignorant of the essential nature of gravity, as we were before Newton clothed its phenomena in a garb of figures; we remain without any real knowledge of the essence of light, though we know to a mile the rate at which it travels; and we are as far off from grasping the nature of the electric fluid as we were before Wheatstone so ingeniously contrived to measure its velocity. And if the real nature and essence of these powers of nature are not to be learnt from any numerical expression of their phenomena, however exact, what hope is there that we shall be more successful in inferring the real nature of the human will from the figures that express the aggregate results of its operation; and what fear lest the foundations of morals and religion should be shaken by numerical coincidences between these results and others, in the bringing about of which human volition has had no share.

These observations will not be deemed unnecessary, or out of place, by those who are aware of the extensive prevalence of misconceptions as to the tendency of statistical enquiries. It must be the anxious wish of every Member of this Society to represent its objects in their true light; and I am sure that I do not misconstrue them when I say that, in aiming at the discovery of truths of the highest order, and of facts admitting of the most beneficent applications, we are not conscious of the presumption of expecting, or of the perverse folly of desiring, to solve the mysteries of the human will, or to draw aside one corner of the thick veil which hides from mortal eyes the intimate nature and essence of the forces, physical and moral, which, in obedience to a higher power, maintain order in the universe, support the life of man, prolong the existence of society, and increase the wealth, extend the empire, and uphold the power, of favoured nations.

As the foregoing Paper is of considerable extent, and embraces a variety of subjects, I have deemed it desirable to present a brief summary of the conclusions which may be drawn from it under the distinct heads of A.—General Principles relating to Annual Fluctuations in Events brought about by the combined operation of a great number of Causes. B.—The rate of Fluctuation in Disease. C.—The rate of Fluctuation in Crime. D.—The rate of Fluctuation in Miscellaneous Events. E.—The inferences to be drawn from the foregoing inquiries respecting the Causes of the Events which exhibit these Annual Fluctuations.

A.—*General Principles.*

1. That the fluctuations which occur from year to year in events brought about by the combined action of a variety of causes, are not fortuitous.

2. That the amount of fluctuation from year to year, in a given series of numerical returns, decreases as the number of facts constituting the series increases.

3. That the fluctuations in the class of events brought about by the human will may be less considerable than in those resulting from the operation of causes over which the will has no control.

4. That some of the higher rates of fluctuation may be accounted for by the small number of facts; others by changes in the nomenclature of the facts themselves; and others, again, by the figures relating to events in course of rapid development, (*e.g.*, steam-vessels, when their value was fully established; machinery, when export of same was permitted; letters sent by post, after the introduction of the new system).

B.—*Rate of Fluctuation in Disease.*

1. That the highest rate of fluctuation belongs to diseases of the Zymotic class; an intermediate rate to diseases of the Organs of Respiration; and the lowest rate to other local diseases, including those which consist of structural degeneracy of the textures of the body; and a low rate of fluctuation to that class of deaths in which human volition plays a principal part.

2. That the rate of fluctuation in the class of Zymotic diseases not only exceeds the rate of fluctuation in all other classes of disease, but also that which prevails in any other order of facts whatever.

C.—*Rate of Fluctuation in Crime.*

1. That the rate of fluctuation in crime is, on the whole, less considerable than the rate of fluctuation in disease; and that it is much less considerable than that which prevails in the case of Zymotic maladies.

2. That the moderate rate of fluctuation in crime finds a parallel in the moderate rate which prevails in the case of a great variety of numerical returns.

D.—Rate of Fluctuation in Miscellaneous Events.

1. That the rate of fluctuation in events other than disease and crime is subject to great variety; the higher rates of fluctuation belonging, for the most part, to events in course of rapid development.

E.—General Inference.

That the rate of fluctuation prevailing in any particular event, or class of events, throws no light whatever on the nature of the causes which may have brought about the event, or class of events, in question; and that, consequently, no inference can be fairly drawn from the comparative steadiness in the figures representing the numbers of crimes as to the nature of the human will, or as to the other causes which have contributed to occasion them.

APPENDIX.

The question raised in the text,—whether the rate of fluctuation in the same order of facts diminishes as the facts increase?—was put to the test by means of a very simple order of facts, namely, the attendances of physicians' patients in the out-patient department of King's College Hospital. The number of men attending in 10 distinct groups of 100, 200, &c., up to 1,000, was carefully abstracted, the average number reduced to the scale of 1,000, and the mean fluctuation calculated for each series, with the following results:—

Men in Attendance.	Number of Men per 1,000 Attendances.	Rate of Fluctuation.
100	412	12·50
200	409	8·69
300	410	9·35
400	405	10·40
500	403	7·55
600	406	7·44
700	405	3·73
800	406	5·82
900	397	7·78
1,000	398	5·03

It will be seen that the rate of fluctuation has a tendency to diminish as the facts increase, but that the decrease is itself subject to fluctuation.
